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Description of  
**DE19909046**

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The invention refers to a multi-layer absorber after the acoustic spring dimension system in the generic term of the claim 1 kind specified as well as to a method to the fabrication and an use of the same.

Such multi-layer absorbers are already admit (WHERE 97/39439, EP-0 121 947-A2). One serves in particular from soft foamed plastic existing soft layer as so-called "spring" and a in contrast to this substantially heavier heavy layer than "mass" of the acoustic vibratory system. The spring dimension system becomes lively by incident acoustic waves arms. By the induced vibrations a part of the hitting acoustic wave energy becomes consumed, so that the multi-layer compound as absorbers and/or. Insulation and/or damping element for acoustic waves serve. Hereby strong noises causing engines are disguised opposite the outside world, so that for example the sound developing in the engine compartment of a motor vehicle only very absorbed/dammed outward and/or. into the passenger compartment of the motor vehicle concerned to penetrate can.

It was not missing at experiments to make the frequency spectrum of the acoustic waves which can be dammed as wide-band as possible what is done via different distribution that the "springs" and "masses" of representing layer elements.

It is also well-known to deform parts of the layer group or the entire layer group by application of Blasform-Verfahren and other copying methods (GB 2,252,073 A, EP 0,185,838 a2). Such <sup>▲ top</sup> deformation methods are used also for local deforming for example the soft layer, in order to form cavities in the layer group (EP 0,274,097 a2), DE 35 34 690 A1).

The invention is the basis the object to meet a "multifunction" as to a large extent as possible: The multi-layer absorber is to be characterised by as low a weight as possible and separate in the

operation, i.e. after the assembly, and with the insert also at temperatures of for example 40 DEG as few as possible disturbing gases, be as simply as possible entsorgbar and cause low manufacturing costs.

The invention is in the claims 1 and 10 characterized. In Unteransprüchen preferential formations of the invention are stressed and in the following description particularly preferential formations are described.

According to the invention is the soft layer in particular by a first Verfahrensstufe into the desired spatial configuration of the final layer group and/or. Multi-layer of absorber brought and the heavy layer is in particular appliziert in different layer thickness and/or different weight per unit areas per unit area on the soft layer in situ. Thereby it is possible, within shortest time the ? measures? screen end of ranges of the heavy layer ?larger?, to make i.e. more thickly or more heavily, in order to be able to react rapidly to certain requirements.

Is recommended the use of the Aufsprühtechnik or presenting technology for the formation of the heavy layer, which exhibits referred fillers and on the other hand bonding agents preferably on the one hand as ?heavy materials?. The specific weight of the filler should amount to about 4 g/ml. Bevorzugte of fillers are granular, blättchenförmige or powdery particles from z. B. Barium sulfate ( $\text{BaSO}_4$ ). Preferential bonding agents are PU.

Even if for the soft layer polyurethan-foam is used, both layers on the base of the same plastic are constructed and therefore together entsorgbar, without these must be isolated.

On the basis the design examples of preferential formations of the invention are described. In it show

Fig. 1 a partial cross section by a front wall part, which is inserted between the lower part of the passenger compartment (underneath the windshield) and the engine compartment, in order to dam an occurring of acoustic sound energy from the engine compartment the passenger compartment. This front wall part is three-dimensional in such a way deformed that by collections and depressions and recesses apparatuses will surround and instruments of the motor vehicle covered and/or can. The front wall part forms a group 1 of layers, of which those the engine compartment turned soft layer 2 from PU (PURE) - foam of open-cellular structure exists. It can rest, does not have however not against the front wall sheet metal. Although the thickness of the soft layer prepared from cut foam plates was 2 in the initial state even and even, it is in accordance with Fig. 1 deforms into a thinner layer. This can exhibit differently thick parts at the edge 1a and in other parts 1K, in addition, an even layer thickness. In the aperture 1b of the group both the soft layer 2 and one are punched out with this connected intermediate layer 4 in a later operation after the applying of the heavy layer, which stretches itself over practically the entire surface of the soft layer, with a layer thickness of between approximately 0.01 and is 0.2 mm häutchenartig thinly trained and consists preferably also of PU, but in contrast to the soft

layer 2 is essentially gas impermeable. Over this intermediate layer 4 the group 1 covered with a heavy layer 3 is, which does not drag on however over the entire surface of the intermediate layer 4, but is missing particularly at the edge 1a and also ring around the recess 1b. Also this heavy layer 3 exhibits different layer thickness; at some layer parts of 3a the heavy layer 3 is substantially thinner compared with other layer parts of 3b and 3c, whereby their weight per unit area is smaller also there and the effectiveness is also lower to work as "mass" in the acoustic vibratory system than at the thicker layer part 3b with larger mass weight. In place of or additionally to the change of the layer thickness can also the filling degree, which is changed heavy layer 3 in fillers with high specific weight, in particular for barium sulfate. A portion from 50 to 80% filler is recommended. As bonding agent PU is recommended. The heavy layer 3 becomes for example from a hochtixotropen polyurethane system, with which fillers are appliziert.

The group 1 forms a outstanding multi-layer absorber, with which heavy layer parts are effective as "mass" and parts of the soft layer 2 as "spring". It was shown the fact that with low weight and more simply and therefore also cost-saving fabrication of these absorbers after the assembly in the operation compared with other multilevel absorbers well-known type degasses substantially less i.e. gases free sets, which are felt as disturbing or harmful. A reason for the fact consists of the fact that without the use from parting agents to casting layer parts in forms one did. Nevertheless simple and a rapid better distribution of the damming can and/or. absorbing function by means of the multi-layer absorber to be reached by the particular calculation of the weight per unit area and/or. the layer thickness of the heavy layer 3.

In Fig. 2 schematically a manufacture stage is described: Over the soft layer 2, which is deformed already by vacuum into the desired form and exhibits at its outside the häutchenartig thin intermediate layer 4 from essentially identical material, becomes in direction of arrow of above a squirting and/or. Spray nozzle 7 along moves. The spray nozzle 7 sprays the starting material for the heavy layer 3 on the intermediate layer 4, by powdery and/or. granular filler particles 5 from Schwerspat as well as bonding agent 6 on the surface for the structure of the heavy layer 3 to be sprayed. Instead the heavy layer 3 can also in accordance with. Fig. 2a from a broad slot nozzle 7a as broad doughy layer volume 3d to be presented. The layer thickness and/or. the portion of the filler particles 5 at the heavy layer 3 7a and/or the soft layer 2 with the intermediate layer 4 can become and/or by different feed rates of the nozzles 7, 7a controlled by changed transportation speed of the nozzles 7. The application of the heavy layer 2 takes place therefore in situ directly on the soft layer 2 and/or. Intermediate layer 4.

In Fig. a schematic cross section is shown 3 by a forming die 8, which is provided with thin channels 9, over in direction of arrow vacuum V outside (in Fig. to form 3 up) the form 8. Over the form 8 of block foam cut out a disc of the soft layer 2 to the form 8 laid is low-cut and at the edge (1a) close. Since the soft layer 2 is essentially open-porously and therefore gas-permeable, these outside by an gas-impermeable, häutchenartig thin film, which serves later than intermediate layer 4, taken off with the result that with manufacturing the vacuum and/or. Suction of air at the area between the form 8 and the soft layer 2 and/or. and the connected

intermediate layer 4 fixed strained over it with the soft layer 2 (in Fig. 3 shown) the soft layer 2 with the intermediate layer 4 closely to the outlines of the form 8 does not put on itself. By adjusting the underpressure (vacuum) so the layer thickness can be decreased in relation to the original condition of for example 10-50 mm to 0.5-4 mm very substantially on up to for example 10% of the original thickness of the soft layer plate. By temperature increase on for example 80-100 DEG C of the form 8 also the soft layer 2 heated set on their outer contours holds itself and some time on this temperature, so that their Rückstellvermögen is substantially decreased or excluded and nevertheless the soft layer 2 with the lying close intermediate layer 4 after removing from the form 8 in the form given by the form 8 holds itself.

In accordance with Fig. 4 in such a manner formed soft layer 2 with fitting the outside becomes (in Fig. 4 also) intermediate layer not shown 4 in the range of the outer edges 1a and the edges around the openings 1b outside by blinds 8, which can be punched out later, taken off, so that when spraying with spraying compound (heavy layer material) by the squirting and spray nozzle the taken off ranges will not provide 7 with a heavy layer 3. After removing the blinds and solidification of the heavy layer 3 the multi-layer absorber is to be provided by stamping machines with a deckle trim and with the breaking through 1b. This edge sealing by squeezing the boundary regions together during the assembly leads to a decreased sound emission in the passenger compartment.

The heavy layer can be appliziert also on that the intermediate layer turned away side of the soft layer.



**Claims of DE19909046**

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1. Multi-layer absorber after the acoustic spring dimension system, with which the spring of a porous soft layer (2) and the mass consist of a heavy layer (3) and both layers a relatively self-stiff, group (1), formed by deforming at least one of the layers, form, characterised in that the heavy layer (3) in different layer thickness (3a, 3b, 3c) and/or with different weight per unit area per unit area to the soft layer (2) is fastened.
2. Multi-layer absorber according to claim 1, characterised in that the heavy layer (3) from up-sprayed layer material is formed, with those powdery, granular or blättchenförmige fillers (5) with relatively high specific weight in bonding agent (6) is dispersed.
3. Multi-layer absorber according to claim 2, characterised in that the fillers (5) a specific weight within the range of 4 g/ml exhibit.
4. Multi-layer absorber according to claim 2 or 3, characterised in that the bonding agent (6) PU exhibits.
5. Multi-layer absorbers after one of the claims 2-4, characterised in that the soft layer (2) deformed and esp. tilted cut foamed plastic exhibits.
6. Multi-layer absorber after one of the preceding claims, characterised in that the soft layer (2) an injected fleece exhibits.
7. Multi-layer absorber after one of the preceding claims, characterised in that the soft layer (2) open-cellular polyurethan-foam with a specific weight between 5 and 200 g/dm<sup>3</sup> exhibits.
8. Multi-layer absorber after one of the preceding claims, characterised in that between the soft layer (2) and the heavy layer (3) a häutchenartig thin and essentially gas-impermeable

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intermediate layer (4) is arranged, which covers the soft layer (2) toward to the heavy layer (3).

9. Multi-layer absorber according to claim 8, characterised in that the intermediate layer (4) a layer thickness between 0,01 and 0.20 mm exhibit.

10. Multi-layer absorbers according to claim 8 or 9, characterised in that the intermediate layer (4) from PU captivate.

11. Method to the fabrication of a multi-layer absorber after one of the preceding claims, with which at least a layer of the group (1) in the outlines of the absorber appropriate form is formed, characterized by the following process steps:

- a) The soft layer (2) is formed in or at a form (8);
- b) on selected ranges of the deformed soft layer (2) that becomes fillers (5) and bonding agent (6) containing material for the heavy layer (3), in particular by Aufsprühen, spraying or presenting appliziert;
- c) the applizierten heavy layer parts (3a, 3b, 3c) are solidified for heavy layer formation.

12. Process according to claim 11, characterised in that a pane or a plate of the soft layer (2), cut from block foam, is covered with an essentially gas-impermeable thin layer (4) and deformed in a vacuum-form (8).

13. Process according to one of claims 11 or 12, characterised in that the strain of the soft layer (2) is made at temperatures between 0 DEG and 145 DEG C.

14. In particular process according to one of claims 11-13, characterised in that the deformed soft layer (2) is taken off at the page bereichsweise by at least a screen (8), covered with the gas-impermeable thin coating (4), before the Aufsprühen, spraying and/or. Present the heavy layer materials effected via a squirting, a spraying or a putting tool (7).

15. Use of a multi-layer absorber after one of the claims 1-10, for sound proofing purposes under the condition that the edge and/or. Interior edge of the soft layer (2) when assembling at the assembly place in squeezed together and/or. - remains to pressed condition.